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EXCHANGE OF RADIOACTIVE PHOSPHORUS BETWEEN THE GRAFT AND WILDING OF A HYBRID PLANT

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According to the fundamental concepts of Michurin's teaching [1], organisms of a multiple nature which combine the species characteristics of both the graft and wilding are formed subsequently to grafting as a result of the exchange of plastic [plastid?] substances between the two components of the grafting process. As a consequence of the effective interaction and physiological interdependence which arise between the graft and wilding, the species characteristics of the hybrid organism are formed. The numerous varieties of fruit-berry plants created by I. V. Michurin by the mentor method represent a striking proof of Michurin's principles of hybridization which were developed still further in the work done by T. D. Lysenko [2].

The fact that an exchange of plastic substances occurs between the two components subsequently to grafting is demonstrated by extensive information of a biochemical nature which has already found its reflection in the literature [3-5].

In the present work we set ourselves the aim of investigating by the isotopic method the relationships which govern the exchange between the graft and wilding. We used radioactive phosphorus for that purpose. The phosphorus was introduced into the plant by the method of vacuum

infiltration in the form of an aqueous solution of sodium phosphate. Hybrids of the tomato plant (F_0) which were obtained by carrying out the following grafts were used in the experiments: Mikado/Golden Queen (4 March 1949), Yellow Cherry/Potato - Leafed (13 April 1949), and Yellow Cherry/Mikado (16 April 1949). In all three cases sodium phosphate was introduced into the hybrid organism through leaves of the graft (see Figure 1).

Several hours after the infiltration had been carried out, the radioactivity was measured in various leaves of the graft and wilding. A lead screen with a circular opening was used in these measurements. The results are shown in Table 1.

The highest activity is exhibited in young leaves 12 hours after introduction of the phosphorus. The activity is about 4-5 times lower in old leaves of the wilding. One must emphasize in this connection that the leaves of the graft and the wilding exhibit considerable differences between each other as far as age is concerned, because a young sprig is grafted on a fully grown wilding. Under the circumstances no radioactive phosphorus can be detected initially in the leaves of the wilding whenever there is a sharp difference in age between the leaves of the two components. However, a noticeable activity is detected in the leaves of the wilding at the expiration of 7 days. The highest activity is found in young leaves and the lowest in roots. Old leaves occupy an intermediate position with respect to radioactivity.

We observed an analogous condition in another experiment. In this case we used a tomato plant hybrid obtained by grafting Yellow Cherry on a Potato-Leaved tomato plant. The concentration of radioactive phosphorus which was introduced into the leaves of the graft was much higher in this case than in the first experiment. It is obvious from the data listed in Table 2 that 12 hours after the introduction of the radioactive phosphorus into a leaf of the graft the highest amount of phosphorus is concentrated in young leaves and a considerably smaller quantity in old leaves and fruit.

In the experiment in question we detected the appearance of radioactive phosphorus in the wilding as early as 5 days after its introduction into the graft. However, in view of the sharp age difference between the leaves of the graft and the wilding, and also the presence in the graft of a large number of young shoots, leaves, and flowers where phosphorus is preferentially accumulated, the exchange of phosphorus between the graft and the wilding is hindered. In order to eliminate in as far as possible the sharp differences between the leaves of the graft and the wilding, we took recourse to the following manipulation.

On 18 July we infiltrated radioactive phosphorus into a leaf of the graft of a tomato plant obtained by grafting Yellow Cherry on Mikado. Counts of radioactivity carried out on the next day showed, as can be seen from Table 3,' that the highest activity was exhibited in young leaves. This relationship remained in force during the following days. In order to expedite the exchange between the leaves of the graft and the wilding, we removed on the 6th of August a part of the principal shoot (see Figure 1) above the infiltrated leaf, in view of the fact that phosphorus was accumulated mainly in this part. Subsequent measurements demonstrated that soon after this operation a considerable amount of radioactivity appeared in the lateral shoot of the graft as well as the leaves of the wilding.

All this shows that phosphorus metabolism proceeds on the highest level in organs and tissues which are young from the physiological standpoint. Our experimental results show that there is an uninterrupted exchange of phosphorus between the graft and the wilding.

Known facts thus established disprove the idea of adherents of Mendel and Morgan [6] to the effect that graft components retain complete independence in the sense that only specific substances typical for them are produced. The results obtained by us confirm the correctness of Michurin's concepts in regard to the mutual exchange of substances between the graft and the wilding in vegetative hybridization.

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3 tables ~~and 1 figure~~ follow.

Figure available on page 275 of original document.